# REQUEST FOR ADDITIONAL INFORMATION

## OFFICE OF NUCLEAR REACTOR REGULATION

## PRESSURE AND TEMPERATURE LIMITS REPORT, REVISION 6

## FIRSTENERGY NUCLEAR OPERATING COMPANY

## BEAVER VALLEY POWER STATION, UNIT 2

## DOCKET NO. 50-412

By letter dated December 9, 2013,[1] FirstEnergy Nuclear Operating Company (the licensee) provided "Beaver Valley Power Station, Unit No. 2 Pressure and Temperature Limits Report, Revision 6," (the PTLR) to the U.S. Nuclear Regulatory Commission (NRC) staff in accordance with Beaver Valley Power Station, Unit 2 (BVPS-2) technical specification 5.6.4. PTLR Figures 5.2-2 through 5.2-6 indicate that intermediate shell plate B9004-1 is the limiting material with respect to the pressure-temperature (P-T) limits for heatup, cooldown, and leak test. However, calculations by the NRC staff based on information provided in the PTLR indicate that the reactor pressure vessel (RPV) inlet nozzles (material ID B9011-1, B9011-2, and B9011-3) may be controlling for certain portions of the pressure-temperature (P-T) limits for heatup, cooldown, and leak test.

In addition, Section 5.2.11 of the PTLR states, in part:

> The pressure-temperature limit curve shown in Figure 5.2-7 was developed for the limiting ferritic steel component within an isolated reactor coolant loop. The limiting component is the steam generator channel head-to-tubesheet region. This figure provides the ASME III, Appendix G limiting curve which is used to define operational bounds, such that when operating with an isolated loop the analyzed pressure-temperature limits are known. The temperature range provided bounds the expected operating range for an isolated loop and Code Case N-640.

Comparison of curves in Figure 5.2.7 to the heatup and cooldown curves based on the RPV beltline appears to demonstrate that ferritic components in the reactor coolant system (RCS) outside the RPV would not be limiting with regard to reactor coolant system heatup and cooldown; however, it is not clear that such components were explicitly considered in the development of the P-T limits for normal heatup, cooldown, and leak test.

BACKGROUND

Title 10 of the *Code of Federal Regulation* (CFR) Part 50, Appendix G, "Fracture Toughness Requirements," states, *"This appendix specifies fracture toughness requirements for ferritic materials of pressure-retaining components of the reactor coolant pressure boundary (RCPB) of light water nuclear power reactors to provide adequate margins of safety…"* In addition, 10 CFR

[1] Agencywide Documents Access and Management System Accession No. ML13344A983.

Part 50, Appendix G, Paragraph IV.A states that, "*The pressure-retaining components of the RCPB that are made of ferritic materials must meet the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), supplemented by the additional requirements set forth in* [paragraph IV.A.2, "Pressure-Temperature (P-T) Limits and Minimum Temperature Requirements"]…" Therefore, 10 CFR Part 50, Appendix G requires that P-T limits be developed for the entire RCPB, consisting of ferritic RCPB materials in the RPV beltline (neutron fluence ≥ 1 x $10^{17}$ n/$cm^2$, E > 1 MeV), as well as ferritic RCPB materials not in the RPV beltline (neutron fluence < 1 x $10^{17}$ n/$cm^2$, E > 1 MeV). Further, 10 CFR Part 50, Appendix G requires that all RCPB components must meet the ASME Code, Section III requirements.

ISSUE

P-T limit calculations for ferritic RCPB components that are not RPV beltline shell materials, may define curves that are more limiting than those calculated for the RPV beltline shell materials. This may be due to the following factors:

1. Some ferritic RCPB components that are not RPV beltline shell materials, such as nozzles, penetrations, and other discontinuities, are complex geometry components that exhibit significantly higher stresses than those for the RPV beltline region. These higher stresses can potentially result in more restrictive P-T limits, even if the reference temperature ($RT_{NDT}$) for these components is not as high as that of RPV beltline materials that have simpler geometries.

2. Ferritic RCPB components that are not part of the RPV may have initial $RT_{NDT}$ values, which may define a more restrictive lowest operating temperature than the RPV beltline shell materials.

REQUEST

1. Discuss how it was determined that the inlet nozzles are not controlling with respect to the P-T limits for heatup, cooldown, or leak test; OR

2. Provide:
    a. P-T limit curves for heatup, cooldown, and leak test for the inlet nozzles, material ID B9011-1, B9011-2, and B9011-3.
    b. Provide the inner diameter and 1/4T neutron fluence values for the inlet nozzles that were used as the basis for determining the adjusted reference temperature (ART) for the nozzles. Describe how the fluence at the 1/4t location was determined.

3. Footnote "C" to Table 5.2-7 of the PTLR states, "as described in Reference 16, the reactor vessel initial $RT_{NDT}$ values for the inlet nozzles are conservatively assigned values. The actual initial $RT_{NDT}$ values for the reactor vessel inlet nozzles are located in BVPS-2 UFSAR Table 5.3-1." Discuss why conservatively assigned values are included in Table 5.3-1 instead of the actual values.

4. Describe how replacement ferritic components in the RCS, outside the RPV (for example replacement steam generators), were accounted for in the development of the P-T limits for normal heatup, cooldown, and leak test.